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PROCEEDINGS

OF

THE ROYAL IRISH ACADEMY.

1841. No. 32.

November 30. (Stated Meeting.)

SIR WM. R. HAMILTON, LL.D., President, in the Chair.

The following communication "on the Compound Nature of Nitrogen," by George J. Knox, Esq., was read by Dr. Kane.

Soon after the discovery of the bases of the alcalies and earths by Sir Humphrey Davy, the compound nature of nitrogen began to be a subject of discussion amongst chemists; but the arguments in favour of this supposition, deduced principally from the nature of the ammoniacal amalgam, led to no satisfactory physical results.

The experiments of Sir Humphrey Davy on the ammoniacal nitruret of potassium, and those of Despretz and Grove on the compounds of nitrogen with iron, copper, &c., have shown that the metals singly (even when aided by the most powerful electrical induction) have not the power of decomposing nitrogen. There is one experiment, however, by Sir Humphrey Davy, from which one might deduce its compound nature.

Upon heating ammonia-nitruret of potassium in an iron tube, he obtained more hydrogen, and less nitrogen, than the ammonia ought to have given.

Again: on mixing this substance with a greater proportion of potassium, he obtained still more hydrogen, and less nitrogen; whereas, on heating the same substance in a tube of *platinum*, the potassium alloyed with the platinum, and the ammonia was given off almost entirely undecomposed.

How can these experiments be explained except upon the supposition that the potassium and the iron had *conjointly* decomposed the nitrogen? The latest experiments which bear upon this subject, and from which I received the idea which led me to this investigation, are those of Doctor Brown, "upon the conversion of Carbon into Silicon," an explanation of phenomena which appears to me most unreasonable, and contrary to all chemical analogy; whilst the supposition of the carbon having reduced the nitrogen is not only a simple but an unavoidable conclusion to arrive at, if nitrogen be a compound substance. To determine, by experiment, the correctness or incorrectness of this idea, it were only necessary to reduce nitrogen by some other substance than charcoal; and should silica result from its decomposition, the problem might be considered to be solved.

Exp. I.—A considerable quantity of ammonia-nitruret of potassium was formed, by passing ammonia over potassium heated in an iron tube; the part which had not been in contact with the tube, having been examined for silica, contained none.

Exp. II.—Ammonia was passed for several hours over pure iron, heated to a dull red heat; examined for silica, it contained none.

Exp. III.—Ammonia-nitruret of potassium was heated with pure iron in an iron crucible, for one half hour, over a large Rose's lamp; the contents of the crucible, on examination, gave silicon and silica, the weight of which was not registered, as it might have been said to have derived a portion of silica from the inner surface of the crucible.

Exp. IV.—Twenty grains of ammonia-nitruret of potassium were heated with twenty grains of pure iron in the *same* iron vessel for one half hour; when treated with nitric and muriatic acids there remained insoluble a small quantity of a brownish colour, which, when fused with carbonate of potash, gave of silica 0.10. The solution, supersaturated with potash, filtered, neutralized, evaporated to dryness, gave of silica 1.450; sum total of silica 1.550.

From these experiments, together with those of Sir Humphrey Davy mentioned above, one might infer that nitrogen is either a compound of silicon and hydrogen, or of silicon, hydrogen, and oxygen; to determine which, synthetically, a current of dry muriatic acid gas was passed over siliciuret of potassium (formed by heating silica with potassium), placed in a bent tube of Bohemian glass, the extremity of which dipped into a cup of mercury, lying on the bottom of a vessel filled with water. The atmospheric air had been previously expelled from the apparatus by a current of hydrogen.

The gases insoluble in water having been collected, were found, on examination, to be hydrogen and nitrogen, the relative proportions of which varied in different experiments.

In two experiments the proportions of hydrogen to nitrogen were four of the former to one of the latter.

In a third experiment, as six of hydrogen to one of nitrogen.

In a fourth, as five of hydrogen to four of nitrogen.

Observation.—White fumes appeared occasionally in the tube, indicating the presence of muriate of ammonia.

Professor Lloyd exhibited a specimen of Rock from Terre Adele.

Professor Mac Cullagh communicated to the Academy a very simple geometrical rule, which gives the solution of the problem of *total reflexion,* for ordinary media and for uniaxal crystals.